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We are indebted to the Hon. Henry L. Ellsworth for a copy of the Patent Commissioners' report, and also for a copy of the correspondence between himself and Gen. Brisbane.

Also to Mr. Chas. L. Schlatter, for a copy of the Pennsylvania canal Commissioner's report; and likewise Mr. S.'s report on the Harrisburg and Pittsburg railroad.

LOW FARES.

The evidence of the successful operation of the system of low fares, comes in upon us daily. The trial has been made on both sides of the Atlantic with equally satisfactory results. In this country, we find many of our main lines have given it a trial, and more recently the State of Pennsylvania has, from economical considerations, adopted the same system upon her public works.

It appears, however, that in the minds of some persons, a misapprehension exists as to what is meant by low fares. The term is entirely relative, and on no two roads could the same meaning be attached to it. There are two principles upon which the tariff of fares are regulated—the one is from the ascertained existing traffic to calculate the price necessary to repay the expenses and charge as much profit as it is thought can be obtained—the prices thus determined are called by way of distinction *high fares*.

The other principle takes into consideration the whole traffic, not only upon the road itself, but upon all parallel routes, whether steamboat, canal, or common road—and to ascertain the accommodations necessary to transport a fair proportion of the whole—the price is then regulated rather with a view to the cost of transportation for a full train than to the charge that individuals may be willing to pay, or in short, to divide the expense incurred among as many as possible, rather than among as few as possible. The prices thus determined are the low fares.

The first principle considers the travel as constant in amount, not to be increased nor encouraged, and takes no cognisance of competing lines. The second principle of course depends upon diametrically opposite views—looks upon travel as capable of being created and invited, and regards the individ-

ual in his private conveyance as a competing line, which with all others of the same nature must be put down.

Among the most striking instances of the successful operation of low fares, we notice that of the Glasgow and Grenock railroad. This line is 22½ miles in length, and has to encounter an opposition on the Clyde from some of the finest steamers of Great Britain.

The receipts on this road for the six months ending 30th

November, 1842, were

£24,248

Expenses during the same period,

10,366—13,882

or nearly \$6000 per mile per annum profit.

The charge on this road, is 9d Sterling for the entire distance, say 18 cts. or 8 mills per mile.

From the character of the stock, this seems to be no extraordinary profit, it is therefore a fair criterion by which to judge of the workings of the system.

REPORT OF THE CANAL COMMISSIONERS OF PENNSYLVANIA, FOR 1842.

This document appears in a much less voluminous form than its predecessors did, and yet contains much matter of interest even to general readers. We shall endeavor to present an outline of its most important features, condensed into as small a space as possible.

The general depression of trade is said to have been especially experienced at Philadelphia and Pittsburg—the two great termini of the State works, and accordingly the annual income is less than had been expected. It appears, however, that the receipts on western products going east have exceeded those of the preceding year, and that there has also been an increase of revenue upon the Delaware and North Branch canals.

In regard to the prospects of the ensuing year, the experiments during the last year with light draft steamboats on the Ohio, are cited as giving the assurance, that during the driest season and lowest water the navigation of that river can be depended upon as furnishing the means of supplying traffic to the canals.

Great expectations, however, are based upon the operation of the sectional portable boats. As far as we can gather from the report, it is intended that the State shall furnish the trucks, etc., for the transportation of these boats and thus encourage individual competition. The small cost of a boat when compared with the extensive capital necessary on the plan upon which the business was formerly conducted leads to the hope that a brisk competition will increase the amount of traffic upon the works—an end which frequent and liberal reductions of toll, have hitherto failed to accomplish, from the trade being exclusively in the hands of a few large companies.

The rivalry of the Baltimore and Ohio railroad, and the consequent diversion of travel from the Pennsylvania lines, are regarded by the commissioners as matters of serious importance and a sufficient inducement

ert all proper means to cheapen the fare, and to reduce the expenses of travel" on their lines of improvement.

By an anomalous policy the State has hitherto furnished motive power and every thing else but the car while she has received less than half of the high fare charged. The expenditure of millions has thus been rendered almost profitless, while but a few thousand dollars were necessary to give her the control of prices, which at a much lower rate would yield a larger profit than they do at present. The extent of loss, by this policy and the manner in which the commissioners propose to obviate it, we give in their own words.

"The estimated and probable cost of the eighty-two miles of the Philadelphia and Columbia railroad, including engines, depots, machinery, stationary power, etc., is over four millions of dollars, while the entire cost to furnish all the cars for carrying the passengers is less than thirty thousand dollars. Notwithstanding this monstrous discrepance, the State, after furnishing the engines, fuel, stationary power, engines, firemen, agents, despatchers, hitchers, switch tenders, etc., has received less than one-half that has been charged upon the passengers travelling over that road. The fare upon each passenger to Columbia has been three dollars and twenty-five cents, of which the State has received only one dollar and sixty-four cents, the companies having received the balance. However strikingly disproportionate this may appear, we believe the disparity is still greater upon the Allegheny Portage railroad. On that section of our improvements, there is thirty-six miles of double track, ten inclined planes, two stationary engines at each plane, and the cost of keeping which in repair, including ropes, locomotives, horse-power, depots, engineers, agents, and men to work and keep up the road, renders it probably the most expensive railroad of its extent in the world; while the whole amount required to stock it with cars sufficient for all the travel that passes it, cannot exceed from four thousand to six thousand dollars. Yet, the price of fare charged on each passenger passing over it has been two dollars, of which the State receives as her proportion, only seventy-eight cents!

"To change the system of carrying passengers, and to approximate as nearly to that which should be adopted, if the passenger cars were owned by the State; and to get the power of limiting the assessments on passengers, and to effect a reduction in the rates of fare, were objects which the board deemed to be indispensable, in order to increase the travel upon our improvements, and to retain even that which we have already. And they are happy in being able to state, that they have made such arrangements, as will effectually change the system, and certainly produce a greater revenue, establish regular and uniform rates, and effect a great reduction in the price of fare upon all passengers travelling from city to city upon our canals and railroads.

"A contract has been made with responsible individuals to supply the cars and to carry passengers over the Philadelphia and Columbia railroad for

one year, at thirty-six cents for each through passenger, the contractors to be at the expense of all the depots, offices, collectors, clerks and agents to attend them; and they have entered into bonds in twenty thousand dollars, for the fulfilment of their contract.

"Arrangements are also in progress, by which it is expected to make still greater proportionate reductions in the price of fare upon the Allegheny Portage railroad, and at the same time to derive a greater amount of revenue from the passengers upon each of these roads than has ever before been received.

"By the plan contemplated, and the agreement entered into, it is stipulated and agreed, that the fare on through passengers shall be only two dollars on the Columbia railroad, one dollar on the Harrisburg and Lancaster railroad, and one dollar and twenty-five cents on the Allegheny Portage railroad, and that the charge in the aggregate upon each passenger, shall not exceed *ten dollars* from city to city. By such a reduction in the rates of fare from those paid during former years, we have every reason to anticipate a considerable increase of travel upon our improvements. But in any event, whether we have less or more, the terms and conditions of our arrangements are such that the State will derive hereafter a greater revenue from any given number of travellers that shall pass over her improvements, than she has ever before received."

It is expected by these changes, and by the reduction of expenditure, that the operations of the next year will prove still more profitable to the State.

The following abstract gives the receipts for one year and the expenses for nine months ending November 30th. The details of the operation of the Columbia road will be given in another place.

Lines. Main line from Philadelphia to Pittsburg, viz:		Tolls collected in 1842.	Expenditures and liabilities for nine mos. ending Nov. 30th, 1842.
Columbia railroad,		\$357,461 50	132,499 45
Eastern and Juniata divisions,		195,780 16	45,072 12
Portage railroad,		124,258 40	96,528 63
Western division,		85,449 42	26,080 00
Total for main line,		762,949 48	300,180 20
Delaware division,		94,459 08	23 545 11
Susquehanna and North and West Branch divisions,		76,112 14	55,066 90
Beaver, Chenango and French Creek divisions,		6,692 99	11,254 49
		940,213 69	
Deduct drawbacks,		19,714 27	
Total receipts,		920,499 42	390,046 70
Deduct expenses for nine months,		390,046 70	
Excess of receipts over expenditures,		\$530,452 72	

It is remarked that the expenses for the three months excluded from the table are materially less than for the navigable months of the year.

The completion of unfinished works is earnestly recommended, and in a special report, the loss to the State is estimated at nearly three millions of dollars, if the Erie extension is not finished—the amount necessary for that purpose being about \$200,000. The importance of this line is very strongly insisted upon.

“The Engineer corps has been reduced to one principal Engineer”—Mr. C. L. Schlatter, of whose services the State has already made ample and satisfactory trial—and judging from the amount of professional labor necessary, we think that he will have enough to do.

“The subject of selling the surplus water on the several lines of our canals and slack-waters, has become important; and in the opinion of the canal commissioners, a prompt disposal of it at every place where it may be in demand, and where it can be used for machinery and milling purposes, will be alike advantageous to the State, and beneficial to the public.

“The erection of such establishments along the lines of our improvements will tend to stimulate enterprize, to develop the resources of the sections of the country where they may be located, and induce investments of capital, which while it gives employment to men in converting grain and other products into marketable articles, will, at the same time be the means of furnishing to our canals and railroads, a great additional amount of tonnage, from which the State will derive an increase of revenue from the use of her public works.”

The report of Mr. J. B. Moorhead, superintendent of motive power on the Columbia railroad, furnishes some data of interest to those engaged in this species of improvement, and also furnishes the statistics of the road for part of 1842.

From this report, we learn that the rope, etc., for the Schuylkill inclined plane used during the year before, has been paid for this year; the stock on hand in the machine shops has to be added to this, and deducting the stock of fuel on hand from the preceding year, there remains a balance of \$10,998 12 to be added to the nett profits.

There are now forty locomotive engines in the possession of the State beside three which are beyond repair or on sale as not suiting the purpose intended. The experience in regard to the use of coal, is worth recording in the language of Mr. Moorhead.

“Repeated attempts have been made to use anthracite coal as a fuel on this road; and with engines constructed in the form of the two last mentioned, (the boiler and tubes being placed in a vertical position over the fire,) the project would no doubt be successful; but it has been fully settled by experiment that a very heavy expenditure would be necessary to fit the engines now in use on the road for that purpose. Bituminous coal, however, has been used in considerable quantities during the last two years, and with en-

ture success. All the engines now on the road are using it to some extent, and I would recommend that at least double the quantity be used as soon as it can be obtained on the opening of the navigation next season. I am satisfied from my experience that a mixture of bituminous coal and wood is decidedly the cheapest fuel for this road. As wood becomes scarce, the proportion of coal can be increased, and if necessary, it can be used altogether, without any material alteration of the engines now in use."

The reduction of the tolls on heavy articles is recommended as this description of freight has been drawn off the road by the competition of other routes.

"Expenses of maintenance of motive power on the Columbia railroad from March 1st, 1842, to November 30th, 1842.

	Total amount.
Foreman, clerk and mechanics at Parkesburg shops	\$11,339 74
Engineers of locomotive engines,	6,405 25
Firemen of " "	4,733 82
Despatcher, laborers, attachers, engineer and firemen of station- ary engine at Schuylkill plane,	5,407 00
" Engineers, firemen and laborers on Schuylkill level,	2,549 12
Mechanics at repair shop, Schuylkill plane,	952 67
" " " Columbia,	1,317 31
Despatcher and laborers at "	2,237 49
State agents on passenger trains,	1,963 00
Watermen,	1,783 10
Horse power on Schuylkill level, at Schuylkill plane and at Columbia,	3,169 46
Superintendent and clerk,	1,986 50
Carrying, cording, moving and inspecting wood,	1,888 99
Water companies for water,	736 63
Sawing and splitting wood,	1,576 62
Oil,	3,104 84
Wood,	17,937 54
Materials for repairs of engines,	7,852 99
Miscellaneous, stationery and printing,	383 83
Repairs of engines done at manufacturing establishments,	452 74
Castings,	679 53
Coal,	4,035 00
Rope for inclined plane,	4,155 37
Ropes, etc., for engines,	203 22
	<hr/> \$86,762 48

SPARK AND SMOKE BURNING.

These nuisances to travellers are no source of profit to railroad companies, the amount of damages paid annually for accidents by fire, being no small item of expense, every fire within half a mile of a railroad being attributed to the sparks from locomotive engines, and as it is difficult to prove

an *alibi* for each spark, the mischief is pretty certain to be fathered upon those who are best able to pay for it.

The use of coal, which in some cases has been enforced by legislative acts, as free from these dangers and inconveniences, is not likely to mend the matter, as the wires of ordinary spark catchers are soon destroyed by the sulphur of bituminous coal, and the sparks which escape are more enduring and therefore more dangerous than those from wood. Anthracite for the use of which but few engines are intended, is the only fuel free from these objections.

A plan which has suggested itself seems to meet some of the difficulties of the case and we give it for what it is worth. The sparks and smoke are the result of imperfect combustion, and any means by which the combustion can be wholly or in part perfected, will in an equal degree, remove these defects. This imperfect combination is of course owing to an imperfect supply of air, and if more air is passed through the furnace the only effect is to increase the quantity of fuel in imperfect combustion. A supply of air in the smoke box is the only remedy, but if this air be cold, it will not finish the combustion, but by its cooling agency will diminish the evaporating power. It is therefore proposed to furnish a supply of pure and heated air to the smoke box. The modes of accomplishing this are various but would all of them be substantially the same. A pipe leading from the open air should pass through the furnace and boiler into the smoke box at its lower part. This end should be directed in such a manner as to prevent the accidental stoppage by cinders—the other should be furnished with a valve or register to regulate the supply of air. A contrivance of this kind must be more effectual if the air could be introduced at a higher temperature than could be attained by passing the pipe directly through the water. To accomplish this it would only be necessary to have one of the lower tubes of the boiler made some two or three times larger than the rest, and through this flue to pass the pipe for introducing the air. This pipe should be led around the sides or top of the furnace and terminate at some convenient place on the outside; it would thus be out of the way of injury in the furnace and give a larger heating surface. Two small pipes, one on each side, would be better than one large one—the heat would be greater and the arrangement more convenient.

It would cost little or nothing to make the trial, by simply fastening one or two pipes into the fire end of the boiler tubes and bringing the tubes through the furnace into the air, while the tubes of the boiler themselves, would temporarily at least, answer the purpose of the rest of the pipe.

Similar contrivances for smoke-burning have been very successfully applied to stationary engines, and it appears to us that the plan above suggested would be a suitable modification for the locomotive. It is at least worth a trial which would not cost more than the wire of a common spark catcher.

CONSTRUCTION OF RAILROADS ON THE PRINCIPLE OF ASSOCIATION.

Few persons are aware that a railroad is now in process of construction upon the principle of associated labor. We have frequently heard of it, but until lately no precise information has reached us upon this subject. We have now the pleasure of laying before our readers, the report of Gen. Brisbane, President and Engineer of the work, and also his correspondence with the Hon. Henry L. Ellsworth.

Although the principles of Gen. Brisbane are not universally received yet no one can fail to be pleased with his enthusiastic perseverance. That much good may be accomplished, and railroads constructed upon this plan where they otherwise would not have been attempted, no one can doubt. There are of course difficulties peculiar to this system, but how well and successfully they have been encountered by Gen. Brisbane, the reader will see for himself.

CORRESPONDENCE BETWEEN THE HON. H. L. ELLSWORTH & GEN. BRISBANE.

Patent Office, Dec. 8, 1842.

Sir:—I have noticed in the public papers with great pleasure your successful efforts in constructing a railroad without the use of much cash.

Will you permit me to request you to state to me the kind of road, and the manner you have accomplished this very desirable undertaking? In these hard times the community will, I think, be largely your debtor.

In the west, where the prairies are quite level, and the timber (oak) tall and straight, I have supposed associated labor might do something. Let me ask—

1. The cost per mile?
2. The practicability of using horses; and how far in your opinion wooden tracks will answer, without so much grading, as horse power only might be needed on them.

I want to learn the cheapest construction. The western States are so deeply involved that they can never complete their works begun, or connect some now finished in different places without adopting your plan; therefore all the information you can give me will be gladly received.

I beg you to accept my last report with the patent office regulations and patent laws. I add also a pamphlet on western improvements, which may interest you.

Accept the assurance of my high respect and best wishes.

H. L. ELLSWORTH.

Gen. A. H. Brisbane, Georgia.

Irwin County, Georgia, Feb. 11, 1843.

To the Hon. Henry L. Ellsworth—

My dear Sir—I was truly gratified on my return from the north to find your communication touching the improvements now covering our extensive country. I am satisfied that a general sympathy will contribute greatly to the common good. The experiment that we are making, and to which you particularly allude, is one which I trust will be attended with the best consequences, but I am desirous that its reputation should not antecede its real merits. For this reason your letter has been left unanswered so much longer than it should have been; for upon my return home many difficulties presented themselves, which threatened the most disastrous results; but the storm has now passed off, and without compromising any important feature of our plan of operations. To understand each other the more easily, al-

low me to premise that I divide labor into three distinct departments—*producing labor, transporting labor and exchanging labor*, and to a certain extent regard the laborers as of distinct classes. Each of these classes have had their separate modes of acting. The landlord interest is distinct from the farming—the farming from the day labor employed by it, the commercial capital furnished by the all puissant banker—the wholesale dealer—and the retailer, the transportation department, the corporate company, the contractor, and his immediate operatives. But these modes have, through the bias of our republican institutions, undergone sensible changes. For instance, no sooner does the agricultural emigrant reach your teeming West, than the two last functions, those of the farmer and day laborer, are merged in the one glorious privilege of freehold proprietorship. With the mercantile interest the case is somewhat similar. Communities organize proper fiscal agents, these are accessible to all and the wisest or wittiest is the surest to exact tribute of his poor fellow exchanger. In the transportation department above I found a degree of vassalage, which, as an engineer, I felt unworthy of the instruments I was compelled to make use of. Here we have the same uncompromising company—the same exacting contractor, o'erlabored wight. Where, in the agricultural interest, the farmer is stricken out, and in the mercantile the banker, so in the transportation I strike out the contractor, and instead of the laborer being a mere hireling, I make him the possessor of the road wrought on. He is placed at once on a footing with the freehold agriculturist and the mercantile capitalist. You now have the philosophy of my plan; let us now enter into the detail required by you. It must have been apparent to you that the hardy sons of Erin, the most athletic men on earth, and emphatically the great transportation class of this country, were selected by me to work out my plan. It is even wittily said that Ireland was intended by our all provident Creator as the grand nursery for all canal and railroad makers. However this may be, I resolved, whoever made these important works for me should own them, and in all my operations as engineer, have directed my attention to this very important result.

Circumstances made me sufficiently acquainted with a body of Irishmen equal to my experiment. But physical force without the aid of talent and capital, was unavailing. I am happy to say that my statement of the above proposition, and the adoption of the important connection between the Gulf of Mexico and the Atlantic, as my field of operations, secured the last two functions, and I have now constituted our transportation department within the State of Georgia, as distinct an element of the body economic, as either the agricultural or commercial. And why not, to adduce a single argument? If this class be not distinct, which of the other two should perform its duties? Not the agricultural surely? The seed-time and harvest are of too important a character, and succeed too rapidly, the one upon the other to allow this. The same objection holds with the merchant. The invoices and sales, with the thousand contingencies balancing these are well calculated to employ the entire attention of the exchanger. Hence neither of these can control the importunate interests of transportation. But, you may ask, can the delver, who works his two horses in the ditch, or in the trucks, even though he may own the fruit of his labor, be entrusted with the conduct of the work labored on? I answer, without the slightest doubt. Whether as actual agent of transportation, or simply as owner of the stock, no one is better calculated to judge of its value, or to care for its welfare, than he who has wrought for it, or who owns it as his all. Who, before this department was taken from the hands of the common wagoner or droger, managed its

interests? These people themselves, and the case is not altered, when a charter is made to cover their operations, or rather to combine them. So far my free labor principle has been confined to Irish laborers, as I have stated; but nothing could prevent your German emigrants from adopting it, save that they are required for the culture of your lands, and heaven knows Ireland is prolific enough of her millions to monopolize the entire land carriage upon my principle.

You next ask me of the character of our work. It is intended for a 30,000 bale crop, but as this may be increased to 100,000 bales in a few years, we graduate our road to 30 feet per mile, lay a wooden structure down equal to the thrust and tonnage of an engine power, and remain satisfied for the outset, to take one 30,000 bales to market with horse power, and over a wooden ribbon, instead of iron rail. Should the cotton increase threefold, the simple addition of iron upon the ribbon would be sufficient, without changing the power; but when it reaches beyond, the horses will be exchanged for steam.

I am satisfied that the tall oak timber of which you speak would suit this species of construction admirably. Let the logs be procured 32 feet long, 6 inches the width to which they should be reduced by hewing, and when hauled to the tracks, eight feet of the smaller end be taken off, and laid cross-ways at the distance of eight feet apart to sustain the remaining twenty-four feet, which will constitute the stringer upon which the ribbon, four inches square, is to be tressnailed to with pins, one inch thick. Instead of letting in the stringer upon the cross-tie, we bore a hole, two inch diameter, through them, and bind them with a wooden pin of the same size. This constitutes, with ties not less than a foot in diameter, a firm foundation for the ribbon, and when the iron rail is superadded, it cannot be better placed than upon the ribbon.

The cost of graduation is 15 cents per yard, and when the excavation is made upon a loamy soil \$2 50 is easily made per day, as the laborer will displace from 15 to 17 yards. The task of a good axeman is eight pieces 32 feet long of good timber, hewed on two sides only, as this is all that is required, in fact it is only necessary to hew the face to be placed uppermost, and simply beat off that which is to lie upon the cross-tie, the points of bearing only being required to be callipered to a proper thickness that they may lie flush. The cost of the four-inch ribbon will be determined by your mills. The laying down of cross-ties and stringers we pay \$5 per 100 feet for, to bring it to the same price with the excavation and embankment, and five men will complete 200 feet with ease in a day.

The ribboning can be tressnailed down at \$1 50 per 100 when the work is done by experienced workmen.

Thus you will have all the data for determining your mills cost. It would be proper in your dense country to reduce the stock labor to \$2 per day in all departments. Less than this will not satisfy the general run of laborers when cash payments are offered by different interests. You inquire the performance of the horse. I have as yet made no satisfactory calculation on this head as we were too late this year for its cotton crop, but a burthen equal to the utmost effort of the horse makes little impression upon the four inch rail. I would only observe here that when the latter was equal to the trade it would be equally so to employ steam. I am satisfied that in a new country the one should precede the other on the same track, of course, in time.

I have now answered your questions, or in round numbers, stated that \$1,500 per mile for graduation, and \$500 for superstructure, should cover the entire cost of the road.

1. That the grade of the road should not vary with the power to be used but turn solely upon the service to be performed, looking first to the use of the horse and then to steam.

2. I would not advise the commencement of a work upon the stock labor principle upon less than 25 per cent. of the estimated cost of the work furnished in *cash*, and this will be required to cover the expenses of food, clothing, tools, wagoning, etc.

3. And lastly, to organize the force, that two years should suffice to accomplish the entire work, for any period longer than this exhausts the confidence of the operatives.

4. I read with great interest your paper on the subject of western settlement. We have purchased a large district of land through which our road passes, and we propose peopling it with a white basis population, as the climate is one of the most salubrious I know, and the soil calculated for sugar cane, the grape vine, the mulberry, and pasturage to an almost unlimited extent. We do not claim the natural richness of your valleys, as we are upon the ridges of the Alleghenies, but our crops and herds are not exposed to the same trials from climate. Our grasses remain green throughout the winter, and our plantations capable of being tended with nameless capital. But I will not enter upon this interesting subject further at present, only promising that if you will find my communication satisfactory, I will suggest in my next, for the consideration of your western landholders, an eligible method of furnishing settlers with landed estates, and still retain for themselves a valuable property in them.

I send by the next mail a small paper edited in connection with our works of improvement in this southern country, and which I think your department will find of service. It is made cheap, that the important interests of which it will treat, may be disseminated at slight cost. I will exchange with you for your interesting publications, which I must request you to send me at your earliest convenience, and although I could not comply with your request, by answering yours time enough for your annual report, it will not be the less acceptable to me from that account. So please send that also.

With sentiments of great regard, I am your obedient servant.

A. H. BRISBANE.

P. S. Let the curvatures be never less than $4\frac{1}{2}$ degrees, or about the fourth of a mile radius. I advise the square ribbon, that the lamina of the wood may be placed vertically, as it exfoliates with the weather too much when placed horizontally. If the horse is used, fill the track to the surface of the ribbon within the rails. When steam is introduced, ram and fill the outer part of the ditches.

REPORT OF GEN. BRISBANE, PRESIDENT OF THE OCMULGEE AND FLINT, OR GULF AND ATLANTIC RAILROAD.

To the Stockholders:

Gentlemen—A second year has now closed, and yet our great work is unfinished. It is not to make excuses, but to render a faithful history of our progress for the last twelve months, that I state the circumstances which have interfered so much with our calculations. Death has had a first influence. It is known to most of you that General Jones, of Lee, our late president and able friend, was the first citizen of the Flint country who responded to the proposition to connect this rich portion of the State of Georgia with the Atlantic ocean. He had scarcely time to exhibit his eminent qualifications for executive control, and to evince his earnest devotion to our enterprise, when the silence of the tomb was exchanged for the bustle and ex-

citements of a transitory existence. The great mind, too, that had caught at a glance the bearing of our undertaking upon the interests of his fellow-countrymen, and as quickly identified them with it the late Bishop England of Charleston, has also gone to his rest, and it is now upon the faith of his reputation only that our work may be said to exist. Nor is this all—a third tried and warm friend has left us to feel most sensibly his last adieu—the Rev. Dr. Graham, the founder of the Catholic churches of Columbus and Macon, and the sandalled priest of the Ocmulgee and Flint railroad, departed this life at a time when the utmost energy of his powerful mind was required to strengthen and enlighten our anxious counsels. Gentlemen, few can realize the efforts that have been required to parry the blow which these melancholy deaths have inflicted upon us. Nor is this all; the restoration of labor to its legitimate valuation throughout the world has occasioned such frightful inroads upon contracts made during its excessive appreciation, that the utmost parsimony and diligence united will not restore for some time sufficient confidence to the great body of the community to allow their capitalists to re-extend their credits; all that is now lent is instantly absorbed by debt. This fact has appeared to us under its most formidable aspect. Of a balance against our stockholders of \$35,000, due on the 1st of January, 1843, not one cent has been paid, and worse, a compromise of 5 per cent. been refused, and suits legally resisted, under the moral plan of debts due to more necessitous creditors. Nor does this apply solely to the *bona fide* stockholders of the road. On the ground of a common interest in the prosecution of our work. I sought from the merchants of Charleston and Savannah, after having pushed the construction to a point of forwardness insuring its early completion in the past year, that aid which fell proportionally to them. In both instances it was fairly promised, and debts for black labor contracted, covering the respective amounts. You were made aware in my July report of the fate of the Savannah subscription: I now grieve to state a similar one on the part of that of Charleston. Seven thousand dollars—the small contribution of twenty odd of her first merchants, with the exception of one or two faithful adherents—has been allowed to stand against them, and the whole debt incurred upon its credit, made to devolve upon the company; and had it not been for the magnanimity of Messrs. Cook and Spalding, of Darien, upon whom the burthen chiefly fell, an utter failure of the enterprize might have been the consequence. These disasters, too, have had their influence upon the principles upon which our road has been constructed—stock labor. Those who toiled for stock directly, felt that its appreciation was indefinitely postponed—those who obtained it by exchange of supplies for fractional shares found these depreciate in the same ratio; so that even where subsistence was all that was required, that, too, appeared daily to grow more uncertain.

Finding every effort unavailing to discover a palliative at home to these formidable disasters, I called the directory together immediately after my appointment to the Presidency, and under its authority hurried to the great seat of trade, trusting that all improvements of a general nature, wherever located, would be interesting there. But the general reaction in the industrial department of the country had already reached the fountain head, and New York was herself in a state of perfect collapse. Consultations with her ablest financial advisers apprised me of this fact, and I once more had recourse to that source which is never applied to in vain for a just charity. Bishop John Hughes of New York has supplied the place, in our destitute condition, of the "Irishman's champion" on this side of the globe, Bishop John England of Charleston, and the simple accession of this great man's

confidence to our enterprise, has again reassured all parties; his moral influence has nerved the arm of the voluntary laborer, and his pecuniary aid has infused new life into our desponding creditors. Thus, gentlemen, has this great national enterprize not only originated, but its fate been determined from a quarter which the world is yet to learn is destined to do much for the cause of civilization. It is now decided that the Irish laborer is not alone the constructor of our great canals and railroads, but that Irish talent and Irish capital are engaged in the improvement of this immense republic—a field of action commensurate only with the daring and industry of the gallant little island. I myself feel confident that the simple history of the Gulf and Atlantic road, achieved by our brave band—a work which the government has been for fifteen years pondering over, and which is even now being croaked of at Washington, will read a warning lesson to the ears of those who pertinaciously adhere to the opinion that “an Irishman is unfit for self-government.”

The actual operations of the road, I am happy to state, are not at all behind the calculations of my last report, when we take into consideration the circumstances above alluded to. The total expenditure for a road of 76 miles, whereon the graduation has been completed, and 50 miles of its superstructure furnished, with the greater portion laid down, and which crosses in its route a rolling country, whose summit level is 300 feet above the rivers whose trade it unites, is **\$123,000—\$100,000** of which has covered its reduction to a grade of 30 feet to a mile, and **\$22,000** a substantial track, over which the heaviest transportation might be conducted. The labor of 100 men for a few months more ought to prepare the entire line for service. The only regret is, that however soon it may be accomplished, it cannot be made available for the present crop for this has been already carried forward to too great an extent. The actual money expenditure since our commencement has been **\$9,000**; a fact which ought at once to stamp the work with a peculiar interest. It marks an important change in the religious and political character of the world. Barbarous nations erected mounds, pyramids, obelisks to denote their individuality; a christian people construct those works and highways which are calculated to unite God's human family. The first depend for their immediate bonds on the daily bread doled out to them by a selfish hand—the second look for a remuneration to those laws which secure equally to every laborer the just award of his individual industry.

Nor are the debts of the company such as to alarm. That incurred at home and for food, is less than **\$5,000**; that abroad, covering the hire for black labor, the clothing of the force, and a portion of the superstructure, and transportation equipage, is not more than double that sum, or **\$10,000**. This statement should not surprise, for where labor is the fruit of self-interest, economy will be found, as well in the transportation department of industry as in the agricultural; each person by our system has in charge the conduct of the entire enterprise.

It is now my duty to suggest such measures as I feel satisfied will, while they sustain public credit, push forward the work to completion early in the coming fall. They are calculated, too, to meet the depression in the money market to which I have alluded, and give a foretaste of the benefits to be derived by the planting interest in the Flint country from our road. The first is to furnish corn to the company, either on stock, or as an advanced payment on the freight of the cotton of the next crop. The second is to rebuke that spirit of distrust in themselves which has crept into the habits of our people, making them, in less than three years fall from a voluntary liability of **\$300,000** to an actual payment of **\$3,000**, or a hundredth part of the

debt. An especial meeting of the stockholders should be had, and the notes of each, where monied means were wanting, pledged in one general fund, to secure a loan equal to the entire debt of the company. I am satisfied some capitalist, sufficiently confident of the value of the work, could be found, who would make the loan of \$15,000, and hold these notes, bearing legal interest, and made payable one year after the completion of the work, as security. There is now due to the company twice this amount, or \$30,000. I believe that I could find such a friend, and by this measure we would at once put a stop to those disgusting process of law, which are calculated not only to tarnish the reputation of our work, but to delude ourselves and our creditors. I cannot urge too positively this necessary measure, for without it, although I may go on as I have, and with individual loans and charity contributions complete the work, the credit of the Flint country must suffer. Besides, there are too many now dependant upon my individual exertions, and have been too long toiling with faith in them to allow me to rely with too much confidence in them myself. It is the duty of the wealthy Flint country to sustain a work which I only commenced under its auspices, and which will ever redound to its honor and profit. Let our stockholders read with care the series of communications, calling upon congress to construct a similar work to ours, more immediately across the southern peninsula, and apply their every arguments to the character of our work, already almost prepared for mail travel and transportation service, adding farther, the important fact, that General Bernard gave ours the decided preference; and when the honorable the Secretary at War shall make public a communication from the engineer department of this road, addressed to him late in the last year, the reasons of General Bernard's preference will be satisfactorily shown.

While in Washington city, I made a point to visit the post office department also, and am happy to state that nothing will prevent the immediate transfer of the general mail to the track of our road, should its advantages be satisfactorily shown over the present mail route. The links of railroad attaching to ours from extreme north to extreme south I have also visited in detail, and from Governor Dudley, of North Carolina, to the Hon. Louis Mc'Lane, of Delaware, found all ready to acknowledge the important services which our work is calculated to render them when completed. The reputation of our work, gentlemen, has gone abroad before completion; completion, then, becomes a duty—failure to complete a disgrace.

Respectfully, A. H. BRISBANE,
President and engineer of the work.

RAILWAYS, THEIR USES AND MANAGEMENT.—LONDON, P. RICHARDSON, 1842.

This is an interesting epitome of all the railways that have been executed and in progress in this country, and is very ably written, affording a brief insight into their cost, working, and management. The following extract, relative to some of our principal engineers, will be read with some interest.

"Most happy should we be if the undertaking had to depend for its success in the parliament upon its own value without the intervention of counsel, as not only would time and money be thus saved, but the real merits of the proposed work would be brought forward more honestly, or if it had not these pretensions and that recommendation, it would lose a false bolster and fall. It is well known that the skill and science of the different engineers is frequently useless to them, with all their assured knowledge, by their failure as witnesses. Thus George Stephenson is never put into a witness-box, if his friends can keep him out, he has not the temper for cross-examination by

persons he considers ignorant of the subject, and with his opinion of himself it would be found impossible to find any person he would submit to. No man however, deserves more credit than George Stephenson, for the manner he has advanced himself in the world, which is in itself no greater proof of his natural abilities, than his acknowledgment of it, is of his real unaffected excellence of heart—he is however a theorist of the wildest kind, and until he became a coal owner, felt that the first things in the world were railways, and the first person George Stephenson. He has, notwithstanding his energy and knowledge of coals, failed to introduce them into public use at a reduction in their price, as he promised he would, and no inland coal will do so, however much its introduction into the metropolis may interfere with the sea-born supply. His railways are not always the best or most profitable, and we think he has made a mistake also in becoming chairman of any railway company. Robert Stephenson, with a higher education is more calm and self-possessed and makes a better witness. Walker, sharp, quick and clever, may always be relied upon for all he undertakes. Sir John Rennie, however, possessed of all the knowledge on the subject, cannot stand the badgering of counsel and forgets his professional service in his gentlemanly feelings. George Rennie is too retired and modest to make known his extensive information and much mechanical knowledge under the ordinary examination of counsel, he must be drawn out, and thus make an honest, conscientious, and intelligent witness. Young Brunel is clever and self-possessed, and would not be easily put down. Locke's testimony would look hard, matter-of-fact, and solid, economical in all its parts. Giles is hasty, anxious, but determined not to be put down; Cubitt, quiet, calm, and firm. Vignolles, energetic and fiery, looking the very personification of some new and wild theory, to be put into immediate practice by his instrumentality, would rather astonish his audience by his bold expostulations and warm support of them, than convince by his arguments and facts, except in matters of detailed and minute expense in practical experience—his evidence has, however, been largely counted on by his employers. Braithwaite is a clever machinist, with an inquiring mind; and in our opinion, has been spoilt by being made a railway engineer; in this latter position his only experience is the Eastern Counties line, and his declaration of the correctness of his original estimates for the whole line to Yarmouth, made at a public meeting a year and a half after obtaining the act, will hardly add to the confidence of the public in his future undertakings; his self-opinion and readiness will always support him, whether as a witness or advocate. Bidder, is, perhaps, the most perfect witness; for though Rastrick has the hardest mouth of any and the most imperturbable determination not to be beaten, yet Bidder, with all the same pertinacity has, in addition, an effrontery of manner (however unintentional) which defies the most resolute opposition; Gibbs is honest and straight forward, and having bought his experience on estimates somewhat dearly on the Croydon, would never again deceive himself, or others."

EXTINCTION AND PREVENTION OF FIRES.

The recent destruction by fire, of much property belonging to railroad companies, affords a suitable opportunity for calling attention to those simple and efficient means which have long been known and successfully adopted for the prevention of fires or their speedy extinction when already kindled. It is hardly to be supposed there would be any backwardness in adopting such means when known, as self-interest, if nothing else, would prompt to their employment. But whether it is that information upon this subject is

inaccessible to those interested (it certainly is not wanting) or that the importance of the matter is underrated; the fact is that a vast amount of property continually exposed to danger from fire, is left entirely unprotected by any preventive application, and is only to be saved when on fire by the use of water, often nearly inaccessible or when obtained, injudiciously applied.

A most effectual preventive against fire, or incombustible paint, is a combination of various salts and earths, which is designed by its ready fusion to exclude all access of air from the wood when once set on fire. The chief requisites are, that the paint should not wash off by rain nor peel off when dry, the materials should be cheap and of easy application. Common white-wash plentifully applied is certainly the simplest and cheapest preparation of the kind. As a proof of its efficacy we have only to pour a quantity of white-wash over a heap of dry brush, and this when thoroughly heated and dried by prolonged exposure to a summer sun, will be found to be absolutely incombustible. There are disadvantages, however, about the common white-wash, such as its slight adhesiveness and disposition to peel off when in thick coats. Various additions have been proposed to obviate these difficulties; salt, ashes, and alum, separately or together, have the property of curing the defects of simple white-wash, and affording a better preventive against fire. From these, in fact, with slight modifications are framed all the principal incombustible paints which have been prepared. A few years since a patent was taken out at Washington by Louis Paimboef for a recipe which, of course, was limited to the proportions there claimed; those proportions, we are told by the editor of the *Journal of the Franklin Institute*, did not appear to be those best suited for the purpose, for the paint both washed and peeled off. Mr. L. A. Sykes, chief engineer of the New Jersey railroad, made some experiments upon this subject, with a view to the preservation of the valuable bridge over the Raritan at New Brunswick. The result was, that water saturated with common salt and mixed with lime and ashes answered more effectually than Paimboef's composition, the proportion of lime and ashes seems to have been observed with no greater nicety than in the preparation of ordinary white-wash.

As an improvement upon this, we would suggest the addition of a small quantity of copperas, by which a far more desirable tint than the staring white of common white-wash would be obtained, while the quality of the paint would be rather improved than otherwise, a strong solution of alum applied over this last preparation when dry would probably afford the best means of bringing this substance into use and also guard more effectually against washing and peeling.

When some slight binder can be cheaply obtained, common road dust or fine sand may advantageously be added; skimmed milk is commonly used for this purpose. Paimboef used, when this last could not be had, rice water, but a cheap size of glue, or common isinglass would answer as well if not better. In India a solution of coarse brown sugar is used in preparing a very beautiful and permanent stucco or cement. The sugar operates by

increasing the solubility of the lime, and thus producing a more intimate union with the sand, by which the further dissolving of the lime is prevented and no fear of washing need be entertained. Molasses may, perhaps, be economically used instead of sugar, neither of them costing much as used for this purpose, perhaps with either of these last binders, and a sufficient quantity of clean sharp sand, an excellent preparation might be made with the addition of nothing else but common salt to the white-wash.

Soluble glass has been proposed and extensively used for the same purpose. For a full account of the preparation and use of this substance, we refer the reader to p. 806, vol. IV. of this Journal. Soluble glass can be cheaply prepared at the glass-houses, and will answer as well as, if not better than, any other composition; it can also be applied to some of the trimmings of cars which are liable to be set on fire.

The means of preventing the spreading of fires are, simply, the application of some compounds similar to those above named, but yet capable of passing through a fire engine without injury to the machine. Solutions of common salt or ashes, separately or together—or else fire-clay or similar matters susgended in water—are the various forms in which it has been proposed to furnish a speedy fire-extinguisher. A recent number of the Journal of the Franklin Institute contains an able article by D. J. Murphy, Holborn, in which the importance of some such composition is strongly urged; but the recipe there given appears to be in no respect original.

The care with which such preparations may be made and applied, should prompt to all at least a fair trial.

INFLUENCE OF RAILROADS.

We find in some of the papers, a statement that, on the occasion of opening a railroad near Venice, the proper ecclesiastical authority, after pronouncing his benediction, launched out into a bitter tirade against such innovations as railroads, which he thought would facilitate the introduction of *books and liberal opinions*. If this be a fact, we cannot but remark that this worthy was not quite so wrong in his estimate of the actual effects of the operation of railroads, as in his opinion of the usefulness of these effects. In that part of the world, the books and liberal opinions would perhaps do as much for the moral, as the railroads would for the physical, improvement of the people.

There is, however, a high authority for the squeamishness of the reverend father, in the reply of an early Russian monarch to the king of Sweden, who had sent him a clock. The clock was returned, with the remark, that such a piece of magic was not fit for a christian king who feared God, and resolved to have nothing to do with the planets.

Such sentiments certainly do not belong to the reigning Russian monarch, who has projected a magnificent system of railways, and probably offers more encouragement to invention than any other government in the world; nor do they belong to the clergy of the church of Rome in this country, who, according to General Brisbane's Report, published in this number, are among the best friends and most energetic supporters of his railroad enterprise.

LETTER TO THE HON. W. GWIN, MEMBER OF CONGRESS FROM MISSISSIPPI.

SIR : The interest you have taken and the great labour you have bestowed upon the question of steam ships for our Navy, must be my excuse for addressing you a communication which, in some of its details, bears upon that subject.

Since my return from Russia in April last, after delivering to the Imperial Government the steamer *Kamschatka*, I have been urged by my friends, and those interested in the subject generally, to publish a full account of the circumstances connected with the building and performances of that vessel. The fact that numerous publications, both in this country and in England, have been industriously prepared by those whose means of information were limited, or whose interest impaired the impartiality of their statements, was urged with much force as justifying this course.

The return of the chief engineer, Mr. Joseph Scott, having supplied me with the facts connected with the performance of the ship during the past season, together with the corroborating report of an officer attached to her, I am enabled to state not only what were the original requirements of the Russian Government, but also the manner in which they have been executed on our part, and the degree of satisfaction that has been given.

The Contract made between Captain Von Schantz of the Russian Navy, and R. and G. L. Schuyler, contemplated the building and equipment (armament excepted, but gun carriages included) of a war steamer, adequate to a force of two 10 inch, or 140 lbs. guns, two 8 inch, or 72 lbs. guns on the upper deck, and sixteen long 36 lbs. guns on the second deck—the necessary ammunition—water, provisions, and stores for two months for 200 men and officers, and fuel for 20 days steaming. The draught of water, loaded as above, when ready for sea, to be not over 16 feet, and the speed to be equal to the best of the English man-of-war steamers, viz. about 8 knots per hour as the maximum under steam without sails. The materials were all to be the best of the kind selected and to pass under the inspection of Captain Von Schantz. The engines were to be on the plan of "Lighthall's Patent Half Beam," and the boilers after the tubular arrangement of R. and G. L. Schuyler, inasmuch as the plans both of engines and boilers had been approved by the Emperor, to whom they had been submitted by Captain Von Schantz upon his return to Russia after a previous visit to this country. The performance of the ship will show that all these requisitions were fully answered and some of them exceeded.

The difficulties of the undertaking were well understood by us. We were aware that English engineers, with all their experience, had made attempts to build steamers of this class which had failed; and that the *Gorgon* and *Cyclops*, constructed under the immediate superintendence of Sir William Symonds did not carry the armament or the fuel intended. It was also questionable at that time whether the heavy wrought iron work necessary for such a steamer could be procured at short notice in the United States.

With what success these difficulties were encountered may be judged of by the statement I shall now submit to you, and by extracts from the report to which I have alluded.

The Hull.—A model was prepared under the directions of Captain Von Schantz after the form and principles of moulding, common in Europe, with improvements by him, especially in the upper works and stern. This model in the part below water was by no means satisfactory to us, nor, as we considered, of adequate displacement. We then prepared a model on the principles we urged as essential to the success of the ship, having particular re-

ference to the water lines and floor, and not intended to show the top or stern we should propose, as those in the first model were so satisfactory as to require no essential change.

This model was prepared for us by Mr. William H. Brown, ship builder, who had been for many years employed by us, and understood perfectly our ideas upon this subject. A third model was then made corresponding substantially to the one proposed by us for the water lines and floor, and to the first one for the top and stern.

From this was the *Kamschatka* built, and the lines of all three are now in our possession. Having assumed certain weights for engines and boilers, (which, to a great extent, could only be matter of supposition in the then condition of the calculations,) and having established the necessary displacements, measures were taken without delay to commence the construction of the hull. A contract was made by us with W. H. Brown who laid the keel in the end of February, 1840, and the ship was launched the 24th of November following. The accuracy of the calculation as regards the weight of the hull and its displacement was then established. The calculation by Captain Von Schantz was 998 tons; by us, 1007 tons. The actual displacement, deducting known weights of some machinery then on board, was 1008 tons.

The draft of water differed less than one inch from the estimates.

The interior arrangements of the ship, exclusive of the engine and boiler rooms, together with all the nautical department, were planned by Captain Von Schantz, and executed under his direction. The gun carriages and platforms were likewise constructed from his drafts.

The Engines.—At the time the contract was made, it was expected that Mr. Lighthall would take the situation of engineer, and that we should have the benefit of his suggestions in adapting his patent to a sea steamer. Other engagements prevented his fulfilling his agreement with us, and left us to construct the engines on his principles, after our own ideas.

The arrangement of the engines being entirely new, though the various parts composing them were easily proportioned and designed, the difficulty of combining an adequate frame for their support, was soon found to be of no small magnitude. Not only was great strength required, but it was essential so to distribute it as to meet the various strains to which the engines of sea steamers are liable. On the arrival of every steamer from England, our investigations confirmed the opinion we had formed, that this portion of the marine engine was far from being perfected.

In the voyage to Russia, which was as tempestuous as any yet made by a steamer in safety, and up to the close of the present season, this frame has not failed in any respect; and it is believed to be one of the few to which additional braces and fastenings have not been added after the test of actual service.

It may not be improper to say, that the system of wrought iron bolts, adopted in this frame, has since found its way into English steamers, plying to this country and elsewhere.

The frame, steam and expansion valves, side pipes, condenser and air pumps of these engines, were constructed, and the whole set up, by H. R. Dunham & Co. under the immediate superintendence, and with scarcely any exceptions, from the drafts of Mr. Robert Schuyler.

The Boilers.—The boilers of the *Kamschatka* have been the subject of much discussion. When the late Board of Navy Commissioners was receiving proposals for the engines and boilers of the *Missouri* and *Mississippi*, the plan of boiler invented by R. and G. L. Schuyler was laid before them,

and its consideration urged on the ground of the importance of burning anthracite coal in our war steamers. The advantages of anthracite over bituminous coal are too obvious to require much comment, but may briefly be enumerated under the following heads:

It is the produce of our own country.

It burns without sparks or smoke.

It has less weight in proportion to the bulk; is free from all risk of spontaneous combustion; and, owing to its hardness, does not slack from the motion of the vessel. In time of war, steamers using bituminous coal will find great inconvenience, from their position being always known to an enemy by their smoke, long before they can see or be seen, and anything like secret movements at night are impossible. The use of anthracite coal remedies this difficulty. Steamers can be kept in as good order, and their sails as white as those of ships; a matter of no little moment in a service where cleanliness is an important branch of discipline. The risk of setting fire to canvas when used with steam is also entirely overcome.

Anthracite coal is now generally used with success in our river steamers; but it is effected by means of an artificial draught; and the quantity of coal consumed per hour is such as to render that mode questionable for sea steamers.

The boilers of the Kamschatka have fully answered our expectations; and while they occupy less space than any boilers constructed to supply engines of the same size here or in England, they have adequate fire surface, and consume less fuel to generate a given quantity of steam, than any others with which I am acquainted. They also can be used for both descriptions of fuel, without any assistance from blowers. We have smaller ones on the same principle in daily use in this harbour, burning anthracite without blast, in which to evaporate a given quantity of water, the ratio of the consumption of fuel in money is as three dollars, where other boilers around us demand five or six.

In September, 1841, the Kamschatka was completed and the fuel and stores for the voyage put on board. The precise weight of the gun, in pigs of lead, was placed in each gun carriage to test the requirements of the contract, and with the crew on board, ready for sea, and extra machinery, which more than compensated for the difference in the compliment of men, the draught of water was precisely the sixteen feet named in the agreement.

The estimated weight of engines, engine frames, boilers and water, had been assumed from the preliminary calculations at 1,009,120 lbs. (450½ tons,) the actual weight when completed was 1,015,392 lbs. (453¾ tons,) a variation of about 6,000 lbs. in a calculation embracing upwards of one million.

The Kamschatka left New-York for Cronstadt about the first of October. In consequence of the lateness of the season, the only trial of her engines before starting on her voyage was a trip of four hours to Sandy Hook and back. Some details of that voyage, in a letter written by me at Southampton, were published in the New-York Courier and Enquirer of November 11, 1841. The passage was made in 21 days, during three of which, for the purpose of testing and reporting upon her sailing qualities, no steam was used. I refer those who consider the Kamschatka a failure, because she did not make the passage in 12 or 13 days, to the fact that though the Cunard steamers *have been* across in that time, yet upon this occasion, the Caledonia, which left Boston on the 1st October, was 20 days, steaming all the time; and, though the same vessel *has been* from Boston to Halifax in 40 hours, the time required for this passage was 6 days. The gale of October, 1841,

was encountered by the *Kamschatka* on the edge of the Gulf Stream without any detriment to engines or waterwheels, while the *Caledonia* close under the land, shipped seas, carried away spars, disabled her waterwheel, and would have been compelled to make a port had she been bound for England without intending to touch at Halifax. The English papers in giving an account of her passage were very confident that no other steamer than one of the Cunard line, would have lived to tell the story.

The voyage across the Atlantic, considered as a test of the performance of the *Kamschatka*, was perfectly satisfactory, and was so reported by Captain Von Schantz to his government. Nothing could be more perfect than the working of engines; but it was discovered on the second day out, that there existed leaks to a considerable extent in the small connections of the flues of the boilers. Any practical engineer can readily understand how much their efficiency would be impaired from such a cause, though apparently trifling in itself. As I have always spoken openly of this leakage as the only misfortune connected with the mechanical execution of the work; it has doubtless been the foundation of some of the reports that the boilers had entirely failed. I now wish distinctly to state in justice to ourselves and to H. R. Dunham & Co., the builders, that these leaks were of a character very common to new boilers, particularly when built of copper and of a large size. Of the 6,400 tubes they contain, not one has ever leaked or failed in any manner; and I have the authority of Mr. Scott, the chief engineer, confirmed by the report to which I have previously alluded to state, that upon our arrival in Russia, a few days labour in caulking obviated the difficulty entirely; and that during the past season they have never given any trouble on that score or any other, or required one dollar for repairs. Had there been time before leaving the United States for the experimental trip as far as Charleston and back, stipulated in the contract, this difficulty would have been easily remedied before her sailing. Indeed, I think much credit is due to the builders engaged in fitting up the *Kamschatka* in every department, that, hurried off as she was without trial, no other than this trifling difficulty presented itself. Those who are familiar with the experimental trials of the Great Western, British Queen, President, and even the Missouri and Mississippi can appreciate the hazard we encountered in permitting her to depart under such circumstances.

Upon our arrival at Southampton we were immediately honoured with a visit from Mr. Benkhausen, the Russian Consul General in London, accompanied by a ship-builder or engineer, who gave the vessel a hurried inspection, making his enquiries of everybody but the officers, and who left her in a few hours for London. The Consul General drew up a report from this visit, which was sent to St. Petersburg in advance of our arrival; the substance of which was, as I was there informed, that the *Kamschatka* was a failure—that her price was enormous—and that better and more powerful steamers could be furnished in England for a great deal less money.

When contracting for the *Kamschatka*, we were well aware that we should have a powerful English influence in Russia to contend against, and it was on that account stipulated that we should supply her with American engineers for one year after her delivery. All the steam ships procured by the Emperor out of his own dominions, up to that time, came from England, the engineers were principally English; and Gen. Wilson, an Englishman, is at the head of the Government machine shops and manufactories at Colpino. The same builder that accompanied Mr. Benkhausen on board the *Kamschatka* is said to have received from that gentleman, all the contracts

for steamers for the Black Sea, and doubtless felt some anxiety, and had some interest in depreciating American workmanship.

Preceded by this report of the Consul General, we pushed up the Baltic through snow, sleet, and ice, in the month of November, and anchored at Cronstadt. The performance of the ship on this voyage with English coals, anthracite having been previously used, was also satisfactory. It had been the intention of the Emperor to be present at a trial of the steamer immediately on her arrival—for this, however, the season was too far advanced. In a few days the harbour of Cronstadt was entirely frozen over, and all trial; and even inspection, by the Emperor was necessarily postponed until the following spring. This gave an opportunity to the English employés of the Russian Government too good to be lost.

Armed with the report of the Consul General in London, there was no end to the stories that were put in circulation about the ship, to the imputations cast upon me, or to the difficulties thrown in my path. General Wilson, after making calculations to prove the engines to be of 260 horse-power instead of 600, and reporting that the Government had been *cheated* by us out of the difference, went so far as to recommend that they should be taken out and adequate ones procured from England. It is not impossible that his recommendations might have been adopted, had it not been suggested that it were as well to try them first. I will not detain you by giving any details of the measures adopted by me to repel these attacks, which I considered national as well as personal; suffice it to say, that the high sense of justice and honour of the Emperor Nicholas, as soon as my statement of facts was made known to him, caused me to be relieved at once from the personal embarrassments in which the action of Prince Menchikoff, the head of the Navy Department, had, under this English influence, involved me. The Emperor's opinion, openly expressed, that as far as he knew, the steamer was satisfactory as regarded her price and performance, was quite enough to silence for a time all cavillers at St. Petersburg.

I mention these circumstances to account for an impression which I find has been general, that the Kamschatka did not answer the expectations of the builders. General Wilson's statements were widely circulated in England and thence found their way to this country. Indeed, some papers in England have asserted, that the machinery was actually taken out, and attributed her performances this summer to the excellence of English engines, even under the disadvantage of being placed in an American model. General Wilson, up to November last, had never visited this steamer in person. He has not confined his hostility to mere statements, but has taken advantage of his position to throw every obstacle in her way. While large sums were expended to improve the steamers that were to compete with her, and picked men placed in the engine departments, convicts were considered by him good enough assistants for her American engineers. The nature of the article in the London Mechanic's Magazine, together with the general character of that journal, is such as not to require any answer. We have since then, however, been applied to by Mr. John Weale, at the request of several engineers in England, for plans of these engines and boilers in his forthcoming work on war steamers. That work, when completed, will afford engineers in England an opportunity fairly to criticise them, when we shall be ready, if necessary, to defend them against unjust attacks.

I proceed to make such extracts from the report previously mentioned and that of Mr. Scott, her engineer, as I think justify me in asserting that the steamer has done more than was expected from her in the original agreement.

"In the middle of May the Kamschatka hauled out of dock, with a crew of 250 men, 200 shells for each of the four big guns, 75 round shots for each of the 36 lbs. guns, provisions for two months, water for six weeks, and 500 tons of coal, bound on a cruise to Finland in company with the second best steamer in the Russian Navy, on board of which was the Grand Duke Alexander, the Emperor's eldest son. Steaming with her four boilers, the Kamschatka easily ran round the other vessel."

"Her second cruise was in company with the Bogatea, the largest and fastest man-of-war steamer in the Russian Navy, to bring the King of Prussia to Cronstadt. This trial had been anxiously expected by all on board; but what sea going steamer can keep up with one which makes never less than 11 and frequently up to $12\frac{1}{2}$ knot per hour as the Kamschatka does? This trial fully settled all questions as to her speed. As a last resource to the English faction, it was declared that if driven up to such speed, her boilers must undoubtedly burst as those in American boats always do; for through the means of English papers, we are provided with full accounts of all disasters to American steamboats. The Prussian King, however, was brought safely to Cronstadt and back again to Prussia, the Kamschatka carrying from 12 to 15 lbs. of steam, and making 12 knots per hour. The Captain received the Prussian order of the Black Eagle and a diamond ring with the King's initials. Her next trip, the Emperor, accompanied by a numerous suite, proceeded in the Kamschatka to inspect the whole fleet then out in the Finland Gulf. We left Cronstadt at midnight with a heavy blow right ahead. During the whole night we made $10\frac{1}{2}$ knots dead to windward—driving the spray over the ship from jib-boom to taffrail. The next day the wind abated and the fleet was inspected. On our return to Cronstadt the Emperor took the Captain by the hand, expressed in the fullest terms his entire satisfaction as to her performance; said that he considered her a cheap vessel, and presented him with a magnificent diamond ring. The Kamschatka made one more trip to Revel, having on board the Consort of the Grand Duke Michael.

"On the 2d of October, the Kamschatka was again ordered out and left Cronstadt to go to the relief of a Russian line of battle ship lost on the coast of Norway. Two crack steamers, one French and one English, left Cronstadt ten hours before us; we encountered a tremendous gale of wind and arrived at Copenhagen 24 hours before either of the other two. We ran the distance from Copenhagen to Elsineur in one hour and three quarters; we once hove the log during this time—the line ran out with $12\frac{3}{4}$ knots before the sand had gone through a 14" glass. We remained nine days on the coast of Norway, and on our return at that late season made our run from Copenhagen to Cronstadt in 66 hours, which never has been done by any other steamer.

"I give you, in conclusion, the data from which you and all other engineers can estimate the performance of the steamer—average steam 16 inches, cutting off at half stroke; $17\frac{1}{2}$ revolutions of a 29 feet wheel; vacuum $28\frac{1}{2}$ inches. She consumes, going easy with a 40 inch cut off, one ton per hour; at a speed of $11\frac{1}{2}$ to $11\frac{1}{2}$ knots 38 tons for 24 hours, and forcing her up to 12 and $12\frac{1}{2}$ knots 42 tons in 24 hours, of bad and rotten English bituminous coals, such as we always have in Russia. Her yards and top-masts are got down in 7 and up in 13 minutes. In beating to quarters, her bulwarks are unshipped in $2\frac{1}{2}$ minutes, her big guns can be loaded and fired every 50 seconds, and steam can be made from cold water in 1 hour and 15 minutes. The boilers are free from leaks, and not one tube has been taken out or replaced."

The above extracts from this report are fully corroborated by the statements of Mr. Scott, as regards speed and consumption of fuel. He also states that he has had no difficulty with the engines and boilers; that the latter are perfectly tight, and supply, if necessary, 20 lbs. of steam. That a consumption of one ton per hour of English coal of inferior quality, supplies her engines with 12 lbs. of steam, cutting off at 40 inches, or one third, with which they will average 14 revolutions per minute; and that to carry 18 to 20 lbs. of steam, cutting off at 60 inches, or one half, the consumption is less than two tons per hour, of the same quality of coals.

The last subject to which I shall call your attention, is that of the comparative cost of the Kamschatka, and the steamers Missouri and Mississippi, which was discussed with much acrimony by a writer in the Philadelphia North American, of November 16, 1841. I shall not enter into the calculations of the writer as to the tonnage, fastening, &c., of the respective ships, because they are founded either upon gross ignorance or intentional misrepresentation. I assume the position that the Kamschatka is as costly as the Missouri and Mississippi, allowing for the difference between the value of white oak and live oak—being as large, as well built, and well fastened, and with engines of the same power. Neither do I claim that her cost should be greater, because those steamers carry no guns on the second deck, it being evident that their construction would admit of such additional force, if desired, provided that their draught of water would allow the ports on the second deck to be cut.

The cost of the Kamschatka, when ready for sea, including all expenses of every description, exclusive of the amount agreed to be paid R. & G. L. Schuyler, was \$418,919, $\frac{7}{10}$.

The cost of the steam ships Missouri and Mississippi, to the 31st December, 1841, as stated by the Secretary of the Navy, was \$1,072,882, $\frac{12}{100}$, or \$536,441, $\frac{44}{100}$ each—to which is appended this remark: "Other expenditures have since been made, presumed to be comparatively small, but the accounts have not yet been returned to the Department."

The difference of the cost between a live oak and white oak frame for the Kamschatka would have been, at the outside, \$20,000.

Although an enquiry recently made by Congress on your motion to the Navy Department will show, it is presumed, the exact cost of the Missouri and Mississippi, I feel quite safe in asserting, that it exceeds that of the Kamschatka one-fourth for each steamer.

You will note, moreover, that in the cost of the Kamschatka, large sums are included for charges, from which Navy Yard vessels are exempted; such as lease of the ground for building the ship, wharfage, salaries and wages of every person employed in and about her; expenses arising from want of fixtures. I may instance the cost of placing the boilers in the ship, which was \$2000. Extra prices were likewise paid with the consent of Captain Von Schantz upon some heavy contracts, to enable the vessel to be completed by September, 1841.

I leave this subject with one concluding remark. In consequence of building the Kamschatka at the same time with our two government steamers, a competition in regard to them naturally arose. This feeling has in some instances been made to bear upon us as if we were not properly interested in the success of our own steamers. To our friends generally, and especially to those attached to the Navy, it would be unnecessary to advert to this subject; but I take this opportunity to state publicly, that all our plans and experience are now, and always have been, at the service of the Navy Department; and that in any criticisms, made here or elsewhere, no reference has

been had to individuals, but to the system adopted by the late Board of Navy Commissioners.

Notwithstanding I throw myself open to the imputations of those who may think my opinions are founded on self-interest, I cannot but maintain that the only mode for our Government to obtain economical and efficient war steamers, is to have them built by contract with responsible individuals, under the superintendence of officers of the Navy. It is by this method only that the skill of our engineers and mechanics can be fully developed; which, if fairly done, need not fear competition with that of any country.

I have the honour to be, with great respect, your ob't serv't,

GEORGE L. SCHUYLER.

New-York, Jan. 30, 1843.

A FEW STATISTICAL FACTS ON THE REVENUE AND EXPENDITURE OF THE TWO MOST EXPENSIVE LONG, AND TWO MODERATELY EXPENSIVE RAILWAYS. BY JOHN HERAPATH, ESQ.

At a time when so much is said upon the question of good and bad railways, and when traffic and expenditure are matters of warm discussion, I have thought a few calculations and observations on the recent reports may not be unacceptable. For the purpose I have in view, I have selected two of the most costly long lines, the Birmingham and Great Western, and two of those which are considered reasonable in their cost of construction, namely, the Grand Junction and South Western.

It will be seen that, in my comparisons, I have had labor which has not been lessened by the very dissimilar manner in which the companies keep their accounts; but, if it will at all aid those to form sounder notions who are anxious to embark in railway property—for I can hardly expect it will be of much service to old railway stagers—I shall consider that my time has not been misspent.

I trust that my readers will distinctly bear in mind that my computations are based upon the data furnished by the last reports of the companies, for the genuineness of any of which data I do not hold myself answerable. If there has been any cooking in any of the accounts, the sin of it is none of mine. All that I hold myself accountable for is the calculations, which I have endeavored to make, and which I hope will be found, correct.

By the last half-yearly reports of the London and Birmingham, Grand Junction, South Western, and Great Western, Companies, the amounts called up in shares and loans, excluding shillings and pence, are—

	Lond. and Birm.	Grand Junction.	South Western.	Great Western.
Shares,	3,615,897	1,780,490	1,825,507	3,009,311
Loans,	2,278,654	483,362	630,100	3,332,025
Totals,	5,894,551	2,263,852	2,455,607	6,341,336

This is what I consider pure capital, disentangled from other items with which the accounts are encumbered. For instance, in the London and Birmingham account is a sum of £9,561 for "premium realized on the reserved new £32 shares," which, though put into the capital account, appears to me to be more of a contingency than, *bonâ fide*, a part of the capital. Again, in the Grand Junction, there is about the same sum made up of sale of refused shares, and of materials which, not having included at the time I made the calculations, though the sale of the refused shares forms certainly a very legitimate element of the capital, is not comprehended in the above statement. So £24,449 made up of "profit on shares," and "interest," carried to capi-

tal in the South Western, I have not called part of the capital, for the same reason as in the London and Birmingham, namely, that it appears to me to be a kind of accidental windfall, rather than legitimate capital. The same might be said of about £3000 in the Great Western account, for "registration fees" and "rents." This company is the only one of the four which does not exhibit a capital account, but gives simply a balance sheet of receipts and expenditure, including the half year's traffic and expenses. In the South Western, £296,545 belonging to the Gosport Branch is at present tantamount to a loan, having only 5 per cent. interest now paid on it. In August next it will be converted into shares, and receive a dividend. At present, however, it diminishes the share capital, and augments the debt, of the company, from 27.15 per cent. to 60.60, as in the following summary:

Thus, for every £100 of actual capital raised by shares, the

London and Birmingham	} have severally	£63.03
Grand Junction		27.15
South Western		34.52 or 60.60
Great Western		110.72

of borrowed money taken up either on mortgage or loan notes. It appears, therefore, that an amount of debt nearly equal to two-thirds of the entire property of the shareholders stands against the London and Birmingham Railway; and a debt of something more than a fourth of their property against the shareholders of the Grand Junction; and in the South Western, of above a third; while in the Great Western the debt exceeds, by nearly eleven per cent., the whole property the shareholders have in the concern. It is not for us to say whether the legislature did, or did not, contemplate such very large debts as are here contracted. Fortunate, however, it certainly is, that in the first, and particularly the last, of these lines, that their per cent. profit upon the whole capital and debt together, exceeds that of their debt; for, were it otherwise, the shareholders would be in a most melancholy position. As it is, it is a great advantage to them to be in debt, and we should recommend them to keep so as much and as long as they can.

The Grand Junction have, by a little dexterity, reduced their capital to only £2,203,300. For, finding their shares at a high premium, they very adroitly hit on an expedient of paying off their debt at a considerable saving to the company, and, at the same time, with great benefit to the shareholders. For instance, they created 17,624 quarter shares, representing in capital only £440,600, and they say to the receivers of these, "Now, if you will take upon yourselves to pay the interest of the debt, and the debt itself, as it falls in, we will give you the full dividend upon these quarter shares, and, when you shall have paid off the debt, we shall save in capital near £100,000." As yet, only 2*l.* 10*s.*, or £44,060, have been called up, and these quarter shareholders stand in this position:—they are receiving at the rate of 3*l.* per annum on the 2*l.* 10*s.* paid up, out of which they have to pay 1*l.* 2*s.* 6*d.* per annum, for interest, leaving 1*l.* 7*s.* 6*d.* net for their clear dividend on their 2*l.* 10*s.* share, or about 54 per cent. But, as a set off, they have still to pay about 27*l.* 8*s.* 6*d.* on each of these quarter shares, besides the already paid sum of 2*l.* 10*s.*; that is, the quarter shares will cost somewhere about 30*l.* each.

In the same way, the London and Birmingham Company are paying the full dividend on their quarter shares, on which only 5*l.* has been paid. I have never, however, heard with what prospective advantage to the company this was done. The Grand Junction plan is a good contrivance eventually for saving capital to the company, though at present at the expense of the

other shares; but the London and Birmingham plan appears to me to be now damaging the original holders, and with no prospective benefit.

Supposing D to be the per cent. amount of debt on the capital actually paid, or the per cent. interest on it, i the per cent. interest on the capital and debts together which the profits would pay, and s the per cent. dividend on the shares or capital alone after paying the interest, we have the following simple equation from which to deduce any one from the rest, namely:—

$$100s + Dd = (100 + D)i$$

$$\text{Whence } s = i + \frac{i - d}{100} D \text{ and } i = \frac{100s + Dd}{100 + D}$$

By the second equation it appears that if the debt was about one-fourth of the paid-up capital, and the interest of the debt was 5 per cent., and the concern paid $11\frac{1}{2}$ per cent., the shareholders ought to divide nearly $13\frac{1}{2}$ per cent. This, as we shall presently see, is the case with the Grand Junction, considering their loan as a debt; but they have only divided 12, in consequence, chiefly, of the heavy sum they have laid by for depreciation and a reserved fund, and the operation of the quarter shares.

If we were to go closer into details, they ought to have a better dividend than we have given them, because we have not taken in the whole of their half-year's income, nor £9000 balance on the preceding account, while we have comprehended every item of their expenditure for the half-year, and have only reckoned the debt 25 per cent., whereas it exceeds 27.

If the debt was two-thirds of the paid-up capital and interest together, and the profits would return 10 per cent. on the whole debt and capital, the shares, with 5 per cent. interest on the loans, might divide near $13\frac{1}{2}$ per cent. on the paid-up capital. This is nearly the position of the London and Birmingham Company. Owing, however, to the large sum set apart for depreciation and the quarter shares, on which, as I have said, only 5*l.* capital is paid up, receiving the full dividend as if 25*l.* had been paid, the old shares only receive $9\frac{1}{2}$ *l.* per share, or about $10\frac{1}{2}$ per cent. Such is the unfortunate operation of these preference shares and the depreciation fund. It is true we have reckoned the debt larger, and, therefore, more advantageous than it is to the shareholders, and have taken the interest divisible upon the total cost greater than it really is; but after making due allowances for all this, the dividend on the shares would cover 13 per cent., if it was not for the operation of the preference shares and the depreciation fund.

With the South Western they only pay 5 per cent. interest on the Gosport branch, that is, on an additional £296,500, which reduces their paid-up capital to £1,529,000, and increases their debts to 926,600*l.*, or to above 60 per cent. of it. On the total of capital and loan, we shall find presently that this company can pay $6\frac{1}{2}$ per cent. Therefore, allowing 5 per cent. upon the debt, which is $\frac{2}{3}$ ths of the paid-up capital, and we shall have 7.80 for the dividend per cent., which might be made on the shares. The amount divided is near $7\frac{1}{2}$ per cent., very nearly the full one, and they hold a balance of 8750*l.* in hand.

The Great Western would pay 5.8 per cent. on the loans and capital, and has 110.7 per cent. of paid capital in loans. Therefore, if 5 per cent. be paid on these, the dividend ought to be 6.7 per cent. on the shares. At the last meeting, a dividend of 6 per cent. was declared.

The length of line run by the London and Birmingham, including the Aylesbury branch, is $119\frac{1}{2}$ miles; of the Grand Junction, including the Liverpool and Manchester, and Chester and Crewe, it is about $133\frac{1}{2}$; of the

South Western, taking in the Gosport branch, 92½; and of the Great Western, including the Bristol and Exeter, and Cheltenham Union, 169 miles. Hence, taking the receipts earned during the past half-year, exclusive of other sources of revenue, and the expenditures, we have—

	Length worked miles.	Half-year's		Half-year's		Per centage of expen. on receipts.	P. ct. on cap. and loans for ½ y'r of		½ yr's profit per cent. on		
		Receipts.	Expend.	Receipts per mile.	Expend. per mile.		Receipts	Expen.	Capital and loans.	Paid up cap. alone	Cost per mile.
L. & B.	119½	£ 429023	£ 134684	£ 3590.2	£ 1132.3	£ 31.685	£ 7.2792	£ 2.3061	£ 4.9721	£ 6.53	£ 52396
Gr. J.	133½	238207	104988	1784.2	784.6	43.973	10.5220	4.6375	5.8845	6.80	21525*
S. W.	92½	153162	70284	1651.3	757.8	45.889	6.2372	2.8622	3.3750	3.91	26475
G. W.	169	337008	152787	1994.2	904.1	45.336	5.3145	2.4094	2.9051	3.35	53968

* This is given by Mr. Moss, the Chairman. The other costs per mile are computed upon the number of miles constructed.

This table affords us some very instructive information.

Many persons, for example, imagine that the amount of traffic per mile per week, as given in the Railway Magazine at the request of some high authorities, is indicative of the value of the line. Taking an extreme case, this would be true, for if a line had no traffic at all, it evidently could be of no value. But the gross amount of traffic, or the amount per mile, goes a very little way towards deciding the merits of a line. For instance, we have here the London and Birmingham at the head of all the railways in receipts, and more than double of another railway, the Grand Junction, which divides upon its whole cost, and with the dead weight of the Chester and Crewe hanging upon it, near 2 per cent. more. Receipts, therefore, are poor criteria of the merits of a line. They are good tests of the quantity of business done, and of the foundation on which profits may be made, but go no further.

Others, again, think the expense per mile a proof of the economy or extravagance of a company in the management of their affairs. This is a position equally as absurd as the preceding. The London and Birmingham is, upon this principle, nearly twice as extravagant as the South Western, and yet it would pay, upon the whole cost, near 3 per cent. per annum more dividend. Again, the Grand Junction is, if expenses per mile are a test, less economical than the South Western; nevertheless, it pays a good way towards double the dividend. A little reflection would tell us that the mileage expenses are influenced more by the amount of business done, than by the economy of management. But there are some, and even public writers, who have such crude notions upon railways, as to make high mileage expenses a ground of complaint against companies.

Equally absurd is another point on which much stress has been laid. I allude to the expenses per cent. of the traffic upon the receipts. Many persons exclaim, if one company transacts their business at a higher per centage than others, that things are worse managed there than where the per centage is much less. Referring to our table again, and we shall perceive the unsoundness of this doctrine. The Grand Junction is near 40 per cent., on the per centage expenses, more expensive than the London and Birmingham, and

nevertheless can divide upon its whole cost at the rate of $11\frac{1}{2}$ per cent., while the London and Birmingham cannot divide 10. Again, the South Western is apparently paying a higher per centage expense on its receipts than the Great Western, and the receipts per mile are much less; and yet it pays at the rate of $6\frac{1}{2}$ per cent. on its cost, while the Great Western cannot pay at the rate of 6 on its cost, though it has divided, and apparently justifiably, at the rate of 6 on the paid-up capital.

The fact is, the per centage expenses depend upon two things, the fares and the amount of business. Other things alike, if the fares are higher, the per centage expenses will be less, and *vice versa*. Again, the more business, the less in proportion is the expense at which it can be done, simply because the standing expenses will bear a less proportion to the receipts, when great, than they will when little. For my part, I would rather see, where there is a scope for business, the per cent. expenses high, for the probability is there would be much more trade and profit.

The fact is, receipts or expenses per mile, or per centage expenses on receipts, are all fallacious foundations upon which, separately, to ground an opinion in favor of any line. *Railways are strictly commercial enterprises, and it is the annual per centage of profit alone on the capital, as in any other undertaking, that determines its value.* The smaller, therefore, this capital is, the more likely the line is to pay, and hence every effort should be made, in the construction of the line, to keep the cost down. Had the London and Birmingham, with its immense trade, (nearly double that of either of the other lines,) been made at anything like its original estimate, or like the cost of either the Grand Junction or South Western, it would, with its economy of working, have paid a magnificent dividend. The same, no doubt, would be the case with the Great Western, when it comes into its full receipts, which will not probably be for these two or three years. Never was economy of construction more forcibly exemplified than in the comparison of the London and Birmingham and the Grand Junction. With more than a double business, and an expenditure proportionably much less, the Grand Junction leaves the London and Birmingham far in the rear of profitable undertakings, for no other reason than that the total mileage cost of construction of the one has been about 143 per cent. more than that of the other. But the Grand Junction, nearly the lowest of the four in the amount of its business, having been constructed the cheapest, stands at the head of them all as a commercial speculation.

Railway Mag.

VARIABLE ORIFICE OF THE BLAST PIPE OF LOCOMOTIVE ENGINES.

In the February number of the *Journal*, I described a "*Self-acting Expansion Slide Valve*," and in the course of the explanation, referred to having obtained patents abroad for an apparatus, by means of which, the orifice of the blast pipe of locomotives can be regulated by the engine driver; I will endeavor in this paper to describe the apparatus, and to point out its general utility.

The determination of the area of the orifice of the blast pipe, is of importance in the construction of locomotives; upon its proportion depends the supply of a sufficient quantity of steam for the service of the engine, and also its comparative effective pressure upon the piston. It may be made so large or so small, as to prevent the engine from performing her allotted amount of duty; and the application of this blast of steam, may be considered (next to the boiler itself,) the most useful invention in this beautiful machine, so essential a complement thereto, that the locomotive engine would have been very imperfect without it. The possibility of its successful application hav-

ing been ascertained, experience promptly indicated the extreme limits of the area of the blast, within which the engine could exert her power; but it still remains to be decided as an invariable rule, what the exact size should be within these limits, to produce the most useful effect; and you will very seldom find any two engineers who adopt the same sized blast, for engines of the same power.

When the diameter of the orifice of the blast pipe is too great, the energy of the blast will decrease, and the draught through the fire will not suffice to generate the quantity of steam required to keep up the speed of the engine; when, on the contrary, the diameter is too small, the resistance behind the piston will become so great, in consequence of the steam not being able to escape through the contracted passage, as sensibly to reduce its effective power on the piston. Within these two extreme limits (if an invariable orifice of blast is adopted) it at first sight appears, that there must be an intermediate point at which, if it could be attained, an engine would perform the greatest quantity of work, with the smallest quantity of fuel. This intermediate point, if it can be admitted to exist, is exceedingly difficult to discover, because a locomotive engine has to overcome a degree of resistance that is constantly changing, either on account of the load, the action of the wind, the state of the rails, or other causes.

In the preceding paragraph, speaking of the extreme limits of the size of blast, within which an engine may work equally well, some doubt is expressed as to whether there exists an intermediate point that might be preferable, as enabling the engine to perform more effective duty. It is probable that within a certain limit, the blast (if invariable) may be made of any intermediate size, without sensibly influencing the average effect produced, the inconvenience and advantage resulting from the change being so nicely balanced, that no sensible difference could be discovered. If such is allowed to be the case, the efficacy of the variable blast must be manifest without a trial.

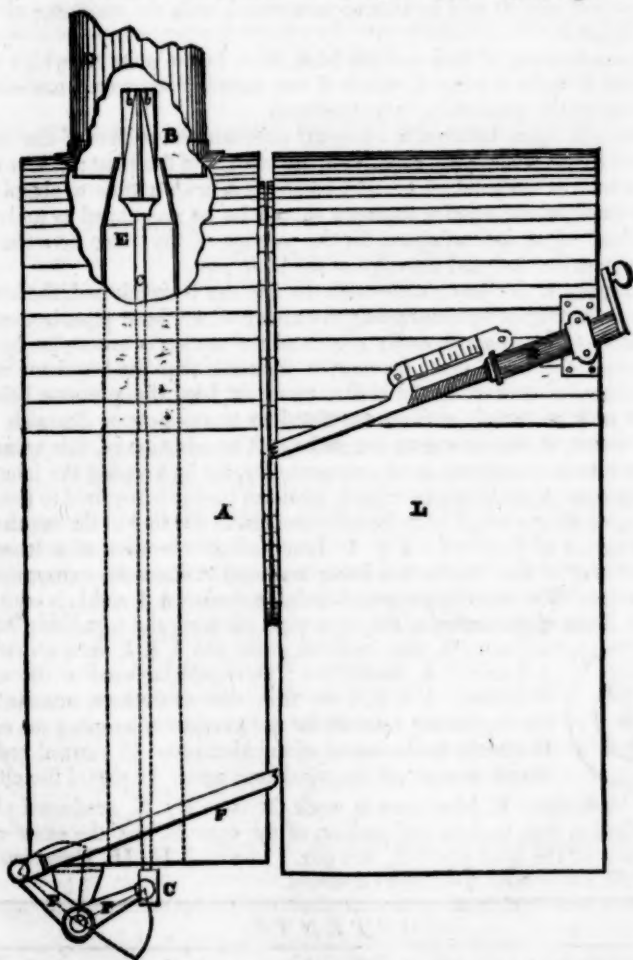
In order to diminish the resistance behind the piston at the return of the stroke, the elasticity of the steam has been taken advantage of; a chamber placed at the foot of the blast pipe, by allowing the steam to expand on its escape from the cylinder, relieves the engine, and has permitted the adoption of the most contracted orifice of blast, that I have yet seen successfully employed. The greatest relief, however, has been obtained by throwing off the steam considerably before the piston arrives at the end of the stroke, thereby enabling it to expand before the return of the piston, and thus very effectually diminishing its resistance; and although by so doing a portion of the effective power of the steam is lost, it is at the same time a judicious choice between two evils, and if not adopted, the discharge of the steam from the cylinder at the moment of the return of the piston would determine a powerful resistance to its free action, and so reduce the effective power of the engine.

The contraction of the blast pipe being an inconvenience inseparable from the condition of generating a good supply of steam in the locomotive boiler, it becomes important to partially remove this inconvenience when practicable; and as the state of the fire, and the quantity of steam required, are frequently varying, it may be positively assumed that an invariable contraction of the blast pipe is an imperfection.

It frequently occurs that there is either too much, or not enough steam in the boiler; when there is too much, it is the usual custom to open partially, and sometimes entirely, the fire door, so that by admitting a current of cold air into the fire box, and through the tubes, the production of steam will be

diminished, but this remedy is very objectionable, and should be applied as seldom as possible.

When there is not enough steam, the draught through the fire, in consequence of the low pressure of the steam, and the slow motion of the engine, will necessarily be less energetic than it ought to be, the means of exciting the fire becoming inefficient at the time when its assistance is most wanted. A good engineer will certainly take care that this occurs as seldom as possible, but there are accidental causes over which he has not sufficient control, and on such occasions the power of contracting the orifice of the blast pipe would be very beneficial, by enabling him materially to increase the rapidity with which the fire would be brought up to its proper state.



By good management, the engineer can therefore have full power over the production of steam, so as at all times to have a good supply, and to prevent almost entirely the loss occasioned by its escape from the safety valves while the engine is in motion; and taking into consideration the frequent occasions on which advantage may be derived by varying the orifice of the

blast pipe, it may be inferred that it is as requisite to have full command of this orifice, as it is to be able to determine the position of the regulator. The speed of the engine may, moreover, be occasionally regulated with advantage, by varying the orifice of the blast pipe, without altering the position of the steam regulator. To carry out, in a practical manner, the variable contraction of this orifice, it is requisite—That the apparatus should be easily constructed and applied, and not liable to get out of order; that its action should be simple and effective; that an indicator should show the area of the orifice under which the engine is working.

Having pointed out the general advantages I propose to derive from the application of a variable blast, I will now describe the apparatus that has been employed, which will be clearly understood, with the assistance of the annexed figures.

In the construction of this variable blast, there is one point on which it is proper here to make a remark, which if not attended to, would materially tend to destroy the good effect to be produced.

The annular space between the internal cone and the orifice of the blast pipe, if too much contracted, diminishes the energy of the blast; so that it is necessary that, at the point of greatest contraction, with a view to obtain the strongest draught, the relative diameter should be so calculated as to leave nearly a half of an inch of space, for the passage of the steam between the internal moveable cone and the edge of the blast pipe.

The intensity of the draught through the fire can be weakened, therefore, either by enlarging or by contracting the orifice of the blast pipe, beyond a certain limit. I have occasionally regulated the motion of an engine by the contraction of the blast pipe, leaving at the same time the regulator wide open, because by contracting the orifice more or less, the pressure behind the piston may be varied, and so regulated as to augment or diminish the effective action of the steam on the piston. The adoption of this variable blast may also be considered as an extra security, for by keeping the internal regulating cone of the blast pipe closed, while an engine is required to remain stationary, no danger could arise from the accidental opening of the regulator.

EXPLANATION OF FIGURES.—Fig. 1. Longitudinal elevation of a locomotive boiler, part of the smoke box being removed to show the extremity of the blast pipe. The circular portion of the boiler between A and L is omitted.

Fig. 2. Plan of the orifice of the blast pipe, showing the regulating internal cone B, with its three guide ribs *b, b, b*, upon an enlarged scale; A, smoke box; B, regulating cone of the variable blast; *b, b, b*, three thin ribs or feathers, attached to the regulating cone B, for the purpose of keeping the cone B exactly in the centre of the blast pipe; C, vertical rod, to which is attached the regulating cone; D, part of the chimney; E, blast pipe; F, hand gear to work the cone B; K, graduated plate fixed to the fire box, to show the position of the cone B, and the exact area of the orifice of the blast pipe; L, fire box.

H. H. EDWARDS.

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